

Networked Constellation Communications Technologies

Completed Technology Project (2016 - 2018)



Project Introduction

This project will identify and develop key communications technologies enabling multi-spacecraft exploration of planetary caves. This project is designed to advance science and technologies related to networked constellations of spacecraft and surface assets, to ensure that the qualitative changes in science and exploration becomes possible with distributed sensors deployment in a low power, challenged environment.

This project will develop communications technologies enabling cave exploration in which multiple science assets perform coordinated operations. Within the challenged environment of a cave, a network of sensor platforms are expected to employing adaptation (e.g., focusing spatially distributed sensors toward an area of interest), guidance (joint mobility/navigation control), and coordination (e.g., task allocation, power management, data relay, and location determination). These networking technologies will be applicable to a broad span of multi-asset missions concepts dominated by pronounced uncertainty of communications link quality, end-to-end relay delay, and cooperative localization (positioning). The technologies developed are designed to function with high degree of autonomy in response to events too dynamic or too remote to be operated by Earth-bound controllers. The network technology will also optimize its operation to maximize efficiency in low power environment.

Key technology goal is to derive a high fidelity statistical model of the communications environment using computation tools and field experiments in order to facilitate mission design and operations planning. Physical layer elements will be modeled to represent channel connectivity and quality among the networked elements.

Anticipated Benefits

Enables the deployment, navigation, and coordinated science operation of a large constellation of cubesat/smallsat using inter-spacecraft crosslinks, multi-hop relay, and RF-based ranging techniques in a challenged environment such as a subterranean cave.



JPL_IRAD_Activities Project

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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Jet Propulsion Laboratory (JPL)	Lead Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations

California

Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Jet Propulsion Laboratory (JPL)

Responsible Program:

Center Independent Research & Development: JPL IRAD

Project Management

Program Manager:

Fred Y Hadaegh

Project Manager:

Fred Y Hadaegh

Principal Investigator:

Jay L Gao

Co-Investigator:

William B Walsh



Images

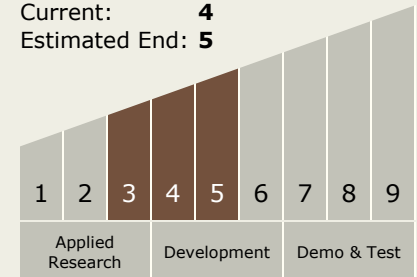


JPL_IRAD_Activities Project Image

JPL_IRAD_Activities Project
(<https://techport.nasa.gov/image/28085>)

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **5**



Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
 - └ TX06.6 Human Systems Integration
 - └ TX06.6.6 Maintainability and Supportability

Target Destinations

Foundational Knowledge, Others
Inside the Solar System

Supported Mission

Type

Push